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Saleha Khumawala
University of Houston

RANASINGHE, Tharindra
Singapore Management University, tharindrar@smu.edu.sg

Claire J. YAN
University of Arkansas, Fayetteville

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Why hedge? Extent, nature, and determinants of derivative usage in U.S. municipalities ☆

Saleha Khumawala [a], Tharindra Ranasinghe [b,*], Claire J. Yan [c]

[a] *Department of Accountancy and Taxation, C. T. Bauer College of Business, University of Houston, 4800 Calhoun Road, Houston, TX 77004, United States*
[b] *School of Accountancy, Singapore Management University, 60 Stamford Road, Level 4, Singapore 178900, Singapore*
[c] *Department of Accounting, Sam M. Walton College of Business, University of Arkansas, Fayetteville, AR 72701, United States*

A B S T R A C T

Using a hand-collected dataset of over 300 observations of large U.S. cities and counties, this paper investigates the extent, nature and determinants of derivatives usage in the municipal sector. Over half of our sample entities engage in derivative transactions and a vast majority of these transactions are intended to manage interest rate risk. Swaps, by far, are the most popular derivative instrument. In terms of the determinants of derivative usage, we find that the propensity to use derivatives as well as the extent of derivative usage is higher for municipalities that are larger and more financially constrained. We do not find growth to be related to municipal derivative usage. Contrary to suggestions made in the popular press, we fail to find managerial opportunism to be a significant factor in municipal derivative usage. We also find that more sophisticated managers of large municipalities and less sophisticated managers of small municipalities are more likely to engage in derivative transactions.

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* Corresponding author.
E-mail addresses: saleha@uh.edu (S. Khumawala), tharindrar@smu.edu.sg (T. Ranasinghe), cyan@walton.uark.edu (C.J. Yan).

1. Introduction

In recent years, the use of derivative instruments by municipalities has attracted much attention from the popular press.[1] The heightened attention was mainly due to highly publicized cases of ill-managed derivative deals that cost the taxpayers billions of dollars and pushed some municipalities to the brink of financial collapse. For instance, Jefferson County, Alabama filed for bankruptcy in November 2011 – the most expensive U.S. municipal bankruptcy at the time – primarily due to ballooning financial liabilities brought about by imprudent use of interest rate swaps related to a series of sewer debt issues (Braun, 2009; McDonald, 2010; Nolan, 2011). Bets gone wrong on derivative transactions cost the City of Detroit close to $400 million (Christoff and Preston, 2013; Francis et al., 2009).[2] According to a 2010 report by Bloomberg News, ill-conceived derivative contracts entered into by governmental entities have cost the U.S. taxpayer more than $4 billion since 2008 in termination fees alone (McDonald, 2010). Notwithstanding these highly publicized cases of mismanagement, it is argued that municipal derivatives are beneficial to the taxpayer not only because they reduce risk, but also because they reduce (interest) expenses associated with debt issues (Dodd, 2010).

While the body of both theoretical and empirical research on derivative usage by the corporate sector is vast, little to no research exists in the domain of derivatives usage by municipalities. Consequently, our understanding of this issue that has significant public policy implications is very limited. Why do municipalities use derivatives? Specifically, what are the determinants of their derivative usage? Is municipal derivative usage consistent with serving the taxpayer or self-serving opportunistic behavior by officials? This paper aims to answer some of these questions by analyzing a comprehensive, hand-collected dataset of derivative usage by the largest cities and counties in the U.S. over the period of 2005–2008. Our sample consists of over 300 observations from 61 cities with populations of over 250,000 and 25 counties with populations of over 1,000,000.

We begin our analysis by examining the nature and the extent of derivative usage in our sample. 55% of our sample municipalities (58% of cities and 46% of counties) engage in derivative transactions. Among the derivative users, the extent of usage is quite significant with the notional values amounting to $574.3 million on average ($667.8 million for cities and $285.6 million for counties).

The vast majority of derivatives relate to managing interest-rate risk. 92% of derivative users (95% of derivative user cities and 82% of derivative user counties) employ interest rate derivatives while 11% of users (seven percent of derivative user cities and 22% of derivative user counties) employ exchange rate derivatives. Among derivative users, only three percent (four percent of derivative user cities and zero percent of derivative user counties) use derivatives associated with commodity prices. The dominance of interest rate derivatives is even greater in terms of the notional value. Based on notional value, 98% of all derivatives held (99% for cities and 95% for counties) are interest rate derivatives. Swaps are the most popular derivative instrument among U.S. municipalities with 83% of all derivative users holding swaps. 17% use swaptions and 14% use forward/futures contracts. Option usage is limited to less than five percent of derivative users.

These findings are broadly consistent with the limited number of related prior studies. These studies indicate the most common exposure hedged through municipal derivatives is interest rate risk with swaps being the most popular derivative instrument (Dotson et al., 1994; Stewart and Cox, 2008). Our analyses also highlight the rapid growth of municipal derivative market over the recent years. For instance, Stewart and Cox (2008) report that in financial year 2003, only 23 of the 100 largest U.S. cities used derivatives. These derivative positions carried a total notional value of $10.6 billion. In comparison for the year 2008, our data covers 59 large U.S. cities and 34 of them use derivatives. Further, the notional value of these derivative positions exceeds $27 billion.

The main objective of this study is to investigate the determinants of municipal sector derivative usage in terms of both the decision to use derivatives and the extent of its usage. Despite the rapid growth of the municipal derivatives market over the years and the numerous controversies surrounding it, currently, there are no systematic academic studies addressing this issue. In developing theories

[1] In this paper, we use the term "municipalities" to denote both cities and counties.
[2] On July 18 2013, Detroit filed for bankruptcy, making it the largest municipal bankruptcy in the U.S. history.

regarding determinants of derivative usage by municipalities, we draw from the related literature in the corporate sector while taking into account the important distinguishing features between municipalities and corporations.[3] We carry out our analyses in two stages. First, using a probit regression, we investigate the determinants of the decision to use derivatives. Next, we use an OLS regression and examine the determinants of the extent of derivative usage.

Our main findings are as follows: We document that financially constrained municipalities are more likely to use derivatives. Both the propensity to engage in derivative transactions and the extent of derivative usage are positively associated with leverage and negatively associated with credit rating. Hence, it appears that benefits of derivatives are greater for financially constrained municipalities because securing smoother cash flows is more valuable for them. Consistent with the large body of corporate sector literature that suggests economies of scale in establishing a derivative program (e.g., Nance et al., 1993; Mian, 1996; Geczy et al., 1997; Haushalter, 2000; Graham and Rogers, 2002), we find a strong positive association with municipality size and the decision to engage in derivative activities as well as the extent of derivative usage. While corporate sector literature argues that hedging is more useful for firms with higher growth opportunities (Froot et al., 1993), we do not find a significant relationship between growth and derivative usage in the municipal sector.

Some argue that corporate sector use of derivatives is driven by managerial opportunism and lack of governance (e.g., Kumar and Rabinovitch, 2013; Lobo et al., 2015; Stulz, 1984; Tufano, 1996, 1998). This concern could be especially important in the municipal sector given the relative lack of monitoring by citizens (Zimmerman, 1977) and recent anecdotal evidence of corrupt municipal officials engaging in derivative activities for self-compensation in the form of gifts and payments from investment bankers (e.g., Braun, 2009). On the other hand, differences in risk appetite between managers and shareholder observed in the corporate sector (where under-diversified managers are more risk averse than well-diversified shareholders) are less prevalent in the municipality sector. Hence, managerial opportunism in the municipal sector may not manifest in greater derivative usage. Consistent with this latter argument, we do not find any large sample evidence to support the notion that managerial opportunism is a significant factor in the decision to use municipal derivatives or the extent of derivative usage. Interestingly, we find that large municipalities with high managerial sophistication and smaller municipalities with low managerial sophistication are more likely to use derivatives. This finding provides credence to concerns raised by regulators that smaller municipalities are susceptible to entering into complex derivative contracts that they do not fully understand (Richardson, 2005).

We believe this paper is of interest to academics, practitioners, and regulatory agencies for at least two reasons. First, we provide relatively recent large sample evidence on numerous aspects of derivative usage in the U.S. municipal sector such as the extent of usage, the type of exposures hedged with derivatives, and the types of derivative instruments used. Second, we provide insights on the determinants that influence the propensity to use derivatives as well as the extent of derivative usage in the U. S. municipal sector. To the best of our knowledge, ours is the first study to carry out a systematic analysis of this nature with respect to the U.S. municipal sector.

The rest of the paper is organized as follows. Section 2 reviews the extant literature on derivatives usage in the municipal and corporate sectors; Section 3 develops our hypotheses; Section 4 describes the data and sample selection; Section 5 presents the research design; Section 6 presents the empirical findings and Section 7 concludes.

2. Literature review

2.1. Derivative usage in municipal entities

A derivative can be defined as a financial contract that derives its value from the performance of an underlying asset (e.g., interest rates, exchange rates, stock prices, etc.). Most commonly used

[3] For example, the notion of using derivatives to smooth cash flows and avoid costly bankruptcies (Smith and Stulz, 1985) can be conceptually applied to the municipality sector as well. On the other hand, corporate derivative usage theories predicated on tax incentives (Smith and Stulz, 1985) are irrelevant to tax-exempt entities such as municipalities.

derivative instruments include swaps, options, forward/futures contracts, and swaptions. While the derivative usage in the municipal sector has grown exponentially over the past few decades (GASB, 2008; Robbins, 2009), little empirical evidence exists on this subject.[4,5] Moreover, there are no reliable estimates on the municipal derivative market since these instruments are transacted privately rather than in a public exchange.

According to Governmental Accounting Standards Board (GASB) (2008), governmental entities may find derivative transactions useful in reducing risk exposures (for example, reducing exposure to interest rate risk by synthetically converting a floating rate debt obligation to a fixed rate obligation via a pay-fixed, receive-variable swap), lowering borrowing costs (some entities argue that pay-fixed, receive-variable swaps result in lower synthetic fixed interest rates than would be achieved by issuing fixed rate debt directly), and managing cash flows (some municipal derivatives include an up-front cash payment). However, imprudent use of derivative instruments could also expose municipalities to significant risks. According to U.S. Securities and Exchange Commission's report on the Municipal Securities Market (2012), these risks primarily stem from municipality officers' unfamiliarity about complex derivative transactions and the various inherent conflicts of interest associated with these types of transactions. Many municipal entities rely upon and trust the financial institutions that sell derivative products and do not solicit services of independent advisors. It has been claimed that the potential for serious conflicts remain even when services of separate advisors are sought, because advisor compensation is contingent upon completion of a transaction, they rely on financial institutions (that sell derivatives) for referrals, and the relationship with the municipal entities is typically limited to the duration of the transaction as opposed to the life of the derivative product. Concerns have also been raised that many municipalities enter into transactions that they do not fully understand and that tend to have excessive fees. Also suggested is that derivative dealers' offers of up-front payments and other benefits as inducements potentially lead to transactions that are both unnecessary and corrupt. The extent of these risks has been illustrated in high-profile derivative debacles such as those involving Jefferson County, Alabama, and the City of Detroit.

As a part of its 1994 report on the U.S. derivatives industry, the United States General Accounting Office (GAO)[6] conducted a survey on the use of financial derivatives by state and local government entities that include municipalities, special districts, and counties.[7] The GAO survey found derivative usage to be rather sparse in the governmental sector with only four percent of 3400 total respondents reporting the use of derivative instruments. In a similar survey conducted by the Government Finance Officers Association (GFOA) and the Municipal Bond Investors Assurance Corporation (MBIA) in 1994, 44% out of more than 1600 respondents indicated they would consider using derivatives, but only six percent had actually done so (Dotson et al., 1994). Neither survey provides an indication as to the magnitude of derivative usage among users.

To our knowledge, Stewart and Cox (2008) is the first attempt to investigate the extent of municipal derivatives usage utilizing information contained in financial statements of municipal governments. Analyzing fiscal year 2003 comprehensive annual financial reports (CAFR) of the 50 states and 100 largest cities in the U.S., Stewart and Cox (2008) finds that 23 state governments and 23 municipal governments engaged in debt-related derivatives transactions. The aggregate

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[4] Abdel-khalik and Chen (2015) attribute some of the growth in overall derivative market to the Gramm-Leach-Bliley Act of 1999 and the Commodity Futures Modernization Act of 2000.

[5] In theory, derivatives can be used for hedging or speculating purposes. Governmental entities are typically prohibited from engaging in derivative transactions for speculative purposes. For example, in its advisory on the use of debt-related derivatives products and the development of a derivatives policy, the Government Finance Officers Association states that, "(derivatives) should not be used for speculation, but only to manage risks associated with an issuer's assets or liabilities" (https://www.sec.gov/comments/s7-25-11/s72511-39.pdf). As a practical matter, a derivative is considered a hedge (speculative transaction) when the entity's exposure to the underlying asset covered by the derivative is greater (smaller) than the product of derivative's notional value and delta. On this basis, all derivatives we have encountered in our analyses can be categorized as hedging instruments.

[6] Effective July 7, 2004 the GAO's legal name was changed from the General Accounting Office to the Government Accountability Office.

[7] In June 1992, the House of Representatives Subcommittee on Telecommunications and Finance of the Committee on Energy and Commerce launched an investigation into financial derivatives markets. The GAO report titled, "Financial Derivatives: Actions Needed to Protect the Financial System" was the outcome of the subcommittee's request to report on the matter.

notional value of the debt-related derivatives positions among the municipalities is reported to be just over $10.5 billion. They also report that more than 90% of the debt-related derivatives instruments used by states and municipalities are interest rate swaps. However, they do not make an attempt to investigate the determinants of derivative usage at either the city or state level.

Overall, a very limited number of studies attempt to document the extent of derivative usage and the type of derivative instruments used in the governmental sector at different points in time. Other than reporting general descriptive information, none of these studies attempt to systematically investigate the determinants of derivative usage in municipal entities. Our paper attempts to shed light on this important issue.

2.2. Insights from corporate sector

In contrast to the governmental sector, a large body of literature exists on the rationale for derivative usage in the corporate sector. It suggests that firms may engage in derivative transactions for either shareholder value enhancement or reasons of managerial opportunism. For example, Smith and Stulz (1985) argue that smoothing of cash flows through derivatives can enhance shareholder value when post-tax cash flows are a concave function of pre-tax cash flows due to progressive tax rates. Nance et al. (1993) and Graham and Smith (1999) find empirical evidence consistent with this argument. Smith and Stulz (1985) also present bankruptcy costs as a rationale for engaging in hedging activities. Consistent with this view, a number of empirical studies document a positive association between derivative usage and firm leverage (e.g., Nance et al., 1993; Tufano, 1996; Haushalter, 2000). Froot et al. (1993) analytically demonstrate that hedging creates shareholder value by alleviating underinvestment problems created by costly external financing. In contrast, the literature also suggests that corporate managers may engage in opportunistic derivative hedging caused by manager–shareholder conflicts of interest and/or divergences in risk appetite between the two parties (e.g., Stulz, 1984; Smith and Stulz, 1985; Tufano, 1996; Knopf et al., 2002; Kumar and Rabinovitch, 2013). The corporate sector literature also documents a strong association between firm size and the extent of derivative usage, suggesting the presence of economies of scale (Nance et al., 1993; Mian, 1996).

It should be noted however, that there are important differences between corporations and municipal entities. First, while the corporate sector has the clearly defined goal of maximizing shareholder value, the success of which can be measured through market prices, objectives of municipalities are invariably broader and more difficult to measure. Second, while much of the theory on the corporate sector derivative usage is based on the premise of well diversified shareholders with utility functions that are risk neutral with respect to wealth, such assumptions are unlikely to hold with respect to citizens and their consumption of municipal services. Third, corporations and municipalities are fundamentally different in their institutional setup (corporate taxation, governance structures, etc.). For instance, agency problems are argued to be more severe in municipalities because the level of monitoring from citizens is not very strong (Zimmerman, 1977). Fourth, the corporate and municipal derivative markets are unlikely to be comparable in terms of market development and product offerings.

Therefore, even though the literature on corporate derivatives could be useful in generating some insights on the municipality sector, its findings cannot be directly applied to municipal entities without further study. For example, the difficulty in clearly defining goals and objectives along with the absence of a "well diversified investor" makes it harder to distinguish between managerial opportunism and value creation objectives of derivative usage in the municipal sector. For instance, while a number of corporate sector studies contend that risk reduction through hedging is appealing to the less diversified manager, but should not create value to well diversified shareholders, one could argue that hedging is value enhancing in the municipal sector because unlike investment portfolios of investors, residence location of municipal residents cannot be diversified away. So, whereas the above argument suggests a positive association between hedging and agency conflicts in the corporate sector, it does not lead to such a prediction for municipalities. In terms of differences in institutional setup, tax convexity based arguments of derivative usage (Smith and Stulz, 1985) are clearly not applicable for municipalities. Moreover, it could be argued that compared to the corporate sector, municipalities exhibit more governance problems and are likely to employ less sophisticated managers (Richardson, 2005). If so, derivative usage in the municipal sector will be exposed to more abusive practices either at hands of opportunistic managers or aggressive derivative salesmen. Still, some arguments presented in the corporate sector literature on derivative usage would apply to municipal sector as well. One example is the need to reduce cash flow volatility in the face of financial constraints.

3. Hypothesis development

In the absence of prior literature that provides a theoretical framework for the use of derivatives by municipalities, in investigating this issue, we draw from the corporate sector literature as well as popular press that discuss issues pertaining to municipal derivative usage.

3.1. Financial constraints hypothesis

Hedging reduces cash flow volatility. To see this, consider a pay-fixed, receive-variable interest rate swap – the most common type of derivatives used by municipalities. Municipalities typically issue floating rate debt. Hence, their interest payments are sensitive to the movements of the underlying index on which the floating rate is based. Pay-fixed, receive-variable interest rate swaps attempt to synthetically convert floating rate debt into fixed rate so that future interest obligations are known with a greater degree of certainty. Reduced volatility of future cash outlays is potentially more valuable to financially constrained entities as even moderately unfavorable fluctuations in cash flows can have severe repercussions for these entities. Consequently, it is reasonable to argue that financially constrained municipalities are more likely to use derivatives. In a similar vein, Smith and Stulz (1985) argue that corporations value derivatives because hedging can reduce the probability of bankruptcy and hence, the associated deadweight costs. Haushalter (2000) finds that among oil and gas producers, firms with higher financial leverage tend to use more derivatives. Tufano (1996) finds similar evidence for the gold mining industry. Therefore, we state our first hypothesis as follows:

H1 (*Financial constraints hypothesis*). There is a positive relation between financial constraints and municipal derivative usage.

3.2. Growth hypothesis

In the corporate sector literature, Froot et al. (1993) argue that derivative usage can alleviate underinvestment problems faced by firms due to frictions in capital markets. Firms with growth opportunities may reduce the level of investment from first-best level in order to economize deadweight costs of external financing. Smoother cash flows facilitated by derivative instruments can reduce the need to access external capital markets and hence ease underinvestment problems. Some empirical studies in the corporate sector report findings that are consistent with this notion. For example, Minton and Schrand (1999) analyze a broad array of firms over the period 1989–1995 and find that higher cash flow volatility is associated with lower levels of capital expenditures. Geczy et al. (1997) investigate the currency derivatives usage of 372 Fortune 500 firms and find that firms with greater growth opportunities are more likely to use derivative instruments.

This line of reasoning can be extended to municipalities in the sense that municipalities that anticipate growing demand for their services would be keener on maintaining smooth cash flows. To the extent that Froot et al.'s (1993) theory is descriptive of derivative usage in the municipal sector we would expect a positive association between growth and derivative usage of municipalities. We formally state this hypothesis as follows:

H2 (*Growth hypothesis*). There is a positive relation between growth and municipal derivative usage.

One could argue however, that aforementioned constraints in accessing capital markets are not severely binding in the municipal sector because unlike corporations, cities and counties can impose taxes on their residents. To the extent that growth needs of municipalities can be relatively easily met via tax increases, the theory of Froot et al. (1993) will be less applicable to municipalities. In that case, we are less likely to observe an association between growth and municipal derivative usage.

3.3. Size hypothesis

Setting up and maintaining a derivative program is costly as it involves transaction costs, personnel costs, systems and software costs, etc. (Brown, 2001). Extant corporate sector research finds a strong and consistent association between derivative usage and firm size, indicating that only relatively large entities are in a position to maintain a derivative program (e.g., Nance et al., 1993; Mian, 1996; Geczy et al., 1997; Haushalter, 2000; Graham and Rogers, 2002). In the municipal sector, the 1994 GAO survey indicates that users of derivatives tend to have greater assets than non-users. Therefore, as our next hypothesis, we conjecture a positive relationship between municipality size and derivative usage.

H3 (*Size hypothesis*). There is a positive relation between municipality size and derivative usage.

3.4. Managerial opportunism hypothesis

A concern raised in the popular press is that municipal managers tend to use derivatives not because of the benefits they accrue to municipalities, but due to opportunistic reasons. As derivative contracts generate large commissions for investment banks, there is concern that these bankers unduly influence city officials into initiating municipal derivative programs through various forms of kickbacks. For instance, former Jefferson County Commission president, Larry Langford, was indicted in December 2008 for taking bribes of $235,000 from an investment banker relating to the issuance of $5.4 billion worth of sewer bonds and swap contracts (Prada and Karmin, 2008). Subsequently, the swap contracts went sour, forcing Jefferson County to file for bankruptcy. Larry Langford was found guilty and sentenced to 15 years in prison.

In the corporate sector literature, Kumar and Rabinovitch (2013) find that derivative usage is positively associated with managerial entrenchment. Lobo et al. (2015) find that managers use derivatives for opportunistic overinvestment. If derivative usage in the municipal sector is driven by managerial opportunism, greater derivative usage would be observed in municipalities where managerial agency conflicts are higher. Hence our fourth hypothesis is as follows:

H4 (*Managerial opportunism hypothesis*). There is a positive relation between managerial opportunism and municipal derivative usage.

However, there are countervailing factors as well. As previously discussed in Section 2.2 and despite anecdotal evidence on managerial opportunism inducing derivative activities in the municipal sector, it has to be noted that both the city officials (agent) and the residents (principal) can be thought of as undiversified and risk averse with respect to municipality outcomes. This contrasts with the corporate sector setting where undiversified managers have stronger incentives to engage in hedging activities than well diversified investors. Accordingly, unlike the corporate setting, there could be greater incentive alignment with respect to engaging in derivative activities in the municipal sector. Hence, both opportunistic as well as benevolent managers could be drawn to derivatives in the municipal sector, making it difficult to find empirical results consistent with hypothesis H4.

3.5. Managerial sophistication hypothesis

Another argument commonly made in the popular press is that financially sophisticated investment bankers, who are attracted by the potential of lucrative commissions, lure relatively unsophisticated city officials into complex derivative transactions that the latter do not completely understand (e.g., Richardson, 2005; U.S. Securities and Exchange Commission's report on the Municipal Securities Market, 2012).

For instance, one of the most common reasons cited by municipalities for using a pay-fixed, receive-variable interest rate swap contracts is that synthetically creating fixed rate debt through derivatives enables municipalities to secure lower interest rates when compared to issuing standard fixed rate debt (Dodd, 2010). Stewart and Cox (2008) provide an illustration where the state of North Carolina, in the context of its 2002 general obligation bond issuances, argues that swap contracts enabled it to lock in synthetic fixed interest rates of 3.283% and 3.089%, whereas standard fixed rate general obligation bonds carry an interest rate of 4.452%.

However, closer observation of these derivative contracts indicates that claims of such massive arbitrage opportunities are rather exaggerated for at least three reasons. First, floating rate municipal debt is typically linked to the SIFMA index, but many swap agreements are linked to LIBOR. Hence, synthetic fixed rate debt created through swaps expose municipalities to basis risk arising through potential mismatching of SIFMA and LIBOR rates (Chu et al., 2008).[8] Second, a typical swap agreement allows the investment bank to prematurely terminate the swap in the face of adverse events such as downgrading of the bond or cross default on other obligations of the municipality. If the municipality is "out of the money" on the swap when termination events take place, the termination can result in substantial unanticipated payment obligations (Chu et al., 2008). According to Bloomberg News, during the period of 2008–2010, Citigroup, JPMorgan Chase & Co. and Bank of America collected more than $4 billion on terminations fees related to derivatives transactions with municipal entities (McDonald, 2010).

Third, derivative programs entail significant costs both in terms of set up costs and investment banking fees.[9] None of the aforementioned risks and costs would be present in the case of municipalities directly issuing fixed rate debt. It is unclear to what extent municipal officials are aware of these intricacies as they initiate derivative programs.

Due to concerns that city officials enter into derivative transactions without completely understanding the complexities of these transactions, the state of Tennessee in 2009 enacted regulations requiring cities and counties wanting to enter into derivative transactions to hire qualified employees, such as a finance chief or accountant, who understand those complex agreements (Nolan, 2010). If municipal derivative usage is symptomatic of a lack of financial sophistication on the part of municipal officials, then we should observe the derivative usage to be less prevalent in municipalities with higher managerial sophistication. Therefore, our final hypothesis is as follows:

H5 (*Managerial sophistication hypothesis*). There is a negative relation between managerial sophistication and municipal derivative usage.

However, a counter argument is that municipalities with greater levels of financial sophistication are more likely to engage in derivatives activities because they better understand these complex transactions. Municipalities with unsophisticated officials may stay away from derivatives due to fear of the unknown. In that case, the relation between managerial sophistication and municipal derivative usage would be positive.

4. Data and sample selection

We gather our data from the Comprehensive Annual Financial Reports (CAFRs) of U.S. cities and counties over the four year period of 2005–2008. Our analyses are unlikely to be affected by the disruptions to the derivative markets during the financial crisis as our sample periods ends in 2008.[10] Due to extensive hand collection efforts involved, we restrict our analyses to cities with

[8] One potential source of basis risk is the risk that the spread between taxable and tax-exempt rates will be less than anticipated due to reductions in marginal tax rate. This facet of basis risk is known as tax risk.

[9] For instance, in the case of Jefferson County, the investment banker who bribed the County Commission president is alleged to have received more than $7 million in fees (Prada and Karmin, 2008).

[10] Triggering the global financial crisis, Lehman Brothers filed for bankruptcy protection on September 15, 2008. In our sample we do not observe significant disruptions to municipal derivative activities in 2008. Municipalities most likely felt the impact of the crisis in subsequent years.

populations of over 250,000 and counties with populations of over 1,000,000 (2008 census). Our final analysis is limited to 61 cities and 25 counties because not all municipalities make their CAFRs available online. This covers 81% (63%) of cities (counties) that meet the aforementioned population threshold. In terms of population, our sample represents around 49 million city residents and 56 million county residents annually. The final sample consists of 337 municipality-year observations (239 city-year observations and 98 county-year observations). Focus on relatively larger entities is appropriate for this study as they are the most likely candidates to use derivative instruments (GAO survey, 1994). However, focusing on larger entities potentially diminish the power of our size hypothesis (H3) tests.

We collect the city and county CAFRs from the website of each entity and carefully review them for disclosures on derivative usage. Municipalities provide detailed disclosures on their derivative usage in notes to the financial statements. If the municipality engages in derivative transactions, we gather relevant details such as the type of instruments, the underlying risks that have been hedged, and the notional value. When the municipality does not make any derivatives related disclosures or explicitly states that they do not use derivatives, we label them as non-users. All other variables used in our analyses are gathered from CAFRs as well. Financial variables relate to total municipality-wide amounts.

Panel A (B) of Table 1 provides the list of cities (counties) used in our analysis along with their respective populations (2008 census) and the number of observations for each city (county).

Given the lack of large sample evidence on the use of municipal derivative instruments in recent times, we present a number of figures summarizing the general trends of derivative usage during our sample period. Fig. 1 reports the time trend of derivative users over the period of 2005–2008. The percentage of cities that use derivatives remains constant at 58%. However, there is an increase in the propensity to use derivatives by counties from 42% in 2005 to 50% in 2008.

Fig. 2 reports the time trend in terms of the aggregate notional value of derivative positions held. While the proportion of municipal derivative users has remained rather steady over the period, Fig. 2 indicates a clear upward trend in terms of the extent of derivative usage. The aggregate notional value of derivative positions for the full sample went up from $22.5 billion to $31.2 billion over the sample period, representing a 39% increase. Total notional value of derivative instruments for cities (counties) went up from $20.1 ($2.4) billion to $27.1 ($3.5) billion, representing a growth of 35 (47)%. These figures provide evidence of the rapid growth of municipal derivatives market over the recent years. As a reference, Stewart and Cox (2008) report the total notional value of derivatives held by the 100 largest U.S. cities in financial year 2003 to be $10.6 billion. In comparison, among the 61 cities investigated in our sample, the 2008 total notional value is as high as $27 billion.

Fig. 3 indicates the underlying risks that are managed through derivative instruments. 92% of derivative users (95% of city derivative users and 82% of county derivative users) employ interest rate derivatives. Eleven percent of derivative users (seven percent of city derivative users and 22% of county derivative users) employ exchange rate derivatives. Only three percent of derivative users (four percent of city derivative users and zero percent of county derivative users) hold derivatives linked to commodities. Untabulated analyses indicate that interest rate instruments overwhelmingly dominate the total derivative portfolios in terms of notional value as well. Interest rate instruments account for 98.2% of notional value of all derivatives held (98.7% for cities and 94.7% for counties). Therefore, we define in all of our subsequent analysis the propensity and the extent of derivative usage in terms of interest rate derivatives. Using the broader definition does not alter any of our inferences.

Fig. 4 reports the composition of interest rate derivatives in terms of type. 83% of municipalities (86% of cities and 73% of counties) that use interest rate derivatives hold swap contracts. Less than 20% hold swaptions and forward/futures contracts. The usage of option contracts is limited to less than 10% of interest rate derivative users.

Next, we discuss the research design with respect to our analyses on the determinants of derivative usage.

Table 1
The sample.

City name	State	# of obs.	Population (2008)
Panel A: Cities			
City of New York	NY	4	8,363,710
Los Angeles	CA	4	3,833,995
Chicago	IL	4	2,853,114
Houston	TX	4	2,242,193
Phoenix	AZ	4	1,567,924
Philadelphia	PA	4	1,447,395
San Antonio	TX	4	1,351,305
City of Dallas	TX	4	1,279,910
San Diego	CA	4	1,279,329
Detroit	MI	4	912,062
San Francisco	CA	4	808,976
Jacksonville	FL	4	807,815
Indianapolis	IN	4	798,382
City of Austin	TX	4	757,688
City of Columbus	OH	4	754,885
Fort Worth	TX	4	703,073
Charlotte	NC	4	687,456
Memphis city	TN	4	669,651
Baltimore	MD	4	636,919
El Paso	TX	4	613,190
Boston	MA	4	609,023
Denver	CO	4	598,707
Nashville-Davidson Metropolitan Government	TN	4	596,462
Washington D.C.	DC	4	591,833
Las Vegas	NV	3	558,383
Portland	OR	4	557,706
Louisville-Jefferson Metropolitan Government	KY	4	557,224
Oklahoma City	OK	4	551,789
Tucson	AZ	4	541,811
Atlanta	GA	5	537,958
Albuquerque	NM	4	521,999
Fresno	CA	4	476,050
Sacramento City	CA	4	463,794
Mesa City	AZ	4	463,552
Kansas City	MO	4	451,572
Omaha	NE	4	438,646
Cleveland	OH	5	433,748
Miami	FL	4	413,201
Raleigh	NC	4	392,552
Minneapolis	MN	4	382,605
Colorado Springs	CO	4	380,307
Arlington	TX	4	374,417
Wichita	KS	4	366,046
St. Louis	MO	3	354,361
City of Tampa	FL	4	340,882
Santa Ana	CA	3	339,130
City of Cincinnati	OH	4	333,336
Aurora	CO	4	319,057
Pittsburgh	PA	4	310,037
Riverside	CA	4	295,357
Stockton City	CA	4	287,037
Corpus Christi	TX	4	286,462
Lexington-Fayette	KY	3	282,114
St. Paul	MN	4	279,590
City of Buffalo	NY	4	270,919
Plano City	TX	4	267,480
Henderson City	NV	4	252,064
Lincoln City	NE	4	251,624
Fort Wayne	IN	1	251,591

Table 1 (*continued*)

City name	State	# of obs.	Population (2008)
Glendale	AZ	4	251,522
City of Greensboro	NC	4	250,642
Total		239	48,851,562
County name	**State**	**# of obs.**	**Population (2008)**
Panel B: Counties			
Los Angeles County	CA	4	9,862,049
Cook County	IL	5	5,294,664
Harris County	TX	4	3,984,349
Maricopa County	AZ	4	3,954,598
Orange County	CA	4	3,010,759
Dallas County	TX	4	2,412,827
Miami-Dade County	FL	4	2,398,245
Riverside County	CA	4	2,100,516
Wayne County	MI	4	1,949,929
Clark County	NV	4	1,865,746
Broward County	FL	4	1,751,234
Tarrant County	TX	4	1,750,091
Bexar County	TX	4	1,622,899
Suffolk County	NY	4	1,512,224
Alameda County	CA	4	1,474,368
Sacramento County	CA	4	1,394,154
Palm Beach County	FL	4	1,265,293
Allegheny County	PA	4	1,215,103
Oakland County	MI	4	1,202,174
Hillsborough County	FL	1	1,180,784
Hennepin County	MN	4	1,140,988
Franklin County	OH	4	1,129,067
Contra Costa County	CA	4	1,029,703
Salt Lake County	UT	4	1,022,651
Honolulu County	HI	4	905,034
Total		98	56,429,449

This table indicates the sample of the study. Panel A (B) provides the list of cities (counties) used in our analysis along with their respective populations (2008 census) and the number of observations for each city (county). Municipalities are in the descending order of population.

5. Research design

We employ the following regression specifications to investigate our hypotheses. (Municipality and year subscripts are suppressed for ease of exposition)[11]:

$$\begin{aligned} Prob(Deriv = 1) &= a_1 Leverage + a_2 CreditRating + a_3 PopGrowth + a_4 LnAsset + a_5 ManagerRun \\ &\quad + a_6 GFOA + a_7 County + a_j Year + a_k Region + E \end{aligned} \tag{1}$$

$$\begin{aligned} DerivNV = a_o &+ a_1 Leverage + a_2 CreditRating + a_3 PopGrowth + a_4 LnAsset + a_5 ManagerRun \\ &+ a_6 GFOA + a_7 County + a_j Year + a_k Region + E \end{aligned} \tag{2}$$

[11] The coefficients reported in the probit regression are the marginal effects, measuring the change in the expected value of the dependent variable as one independent variable increases by unity while all other variables are kept constant. Therefore, the intercept is omitted.

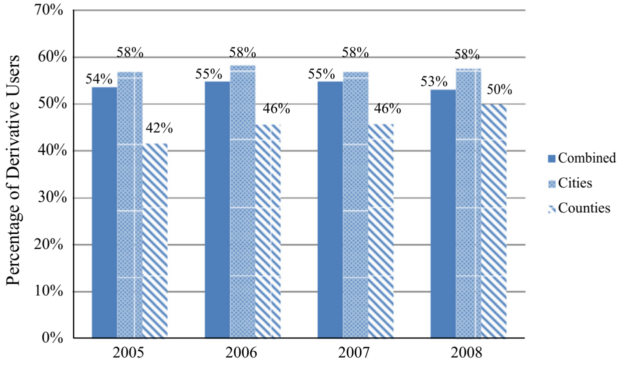

Fig. 1. Time trend of derivative users: 2005–2008. The figure indicates the percentage of derivative users in our sample over the period of 2005–2008. The three blocks of each year separately show the percentage of derivative users out of the combined sample, cities, and counties.

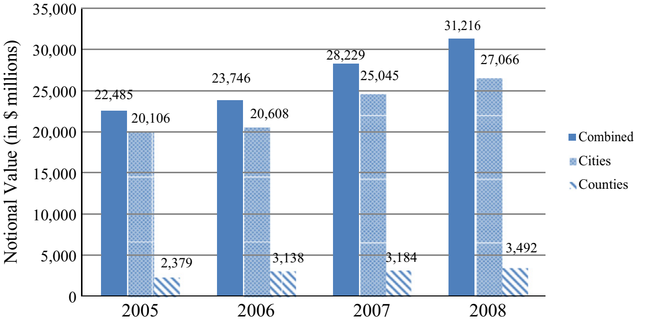

Fig. 2. Time trend of the aggregate notional value of derivative positions held. The figure indicates the time trend of the aggregate notional value of derivative instruments held by municipalities over the period of 2005–2008. The instruments include interest rate, foreign exchange rate, as well as commodity price derivatives. The three blocks of each year separately show the aggregate notional values for the combined sample, cities, and counties. Amounts are in millions of dollars.

As our hypotheses attempt to identify factors that drive derivative usage of municipalities, we investigate these factors in terms of their relation with both (i) propensity to use derivatives and (ii) extent of derivative usage.

Model (1) is a probit model where *Deriv* is a binary variable taking the value of one if the municipality uses derivative instruments and zero otherwise. Model (2) is an OLS specification where the dependent variable measures the extent of derivative usage. Specifically, *DerivNV* is defined as the notional value of derivative positions in a municipality in a given year (in $ millions). Only derivative-user municipalities are included when running Model (2) regression.

Hypothesis H1 predicts a positive relation between derivative usage and financial constraints. To test this supposition, we employ two measures of financial constraints; (i) Financial Leverage (*Leverage*) and (ii) Credit rating (*CreditRating*). We measure *Leverage* as the ratio of total liabilities to total assets. The variable *CreditRating* represents the credit rating of the municipality's general obligation bonds. *CreditRating* takes values from zero to nine with higher values representing better credit quality.[12] Hypothesis H1 predicts a positive coefficient on *Leverage* (α_1) and a negative coefficient on *CreditRating* (α_2).

[12] Specifically, using S&P terminology following numeric values are assigned for each rating category: AAA = 9, AA = 8, A = 7, BBB = 6, BB = 5, B = 4, CCC = 3, CC = 2, C = 1, D = 0.

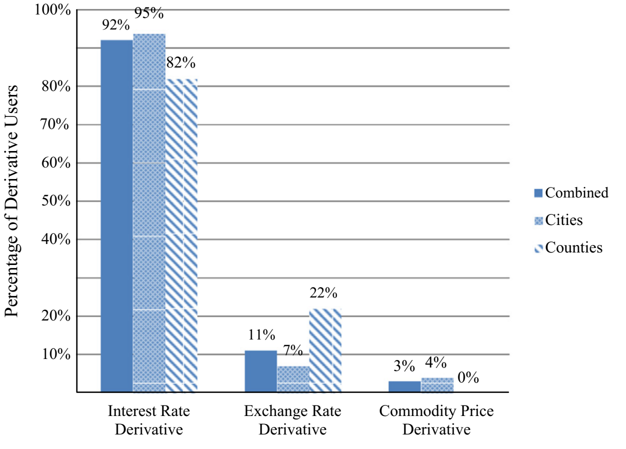

Fig. 3. Derivative types based on risks managed. The figure indicates the types of derivatives used based on the underlying risk that is managed. The three blocks of each instrument separately show the percentage of derivative instruments users for combined sample, cities, and counties.

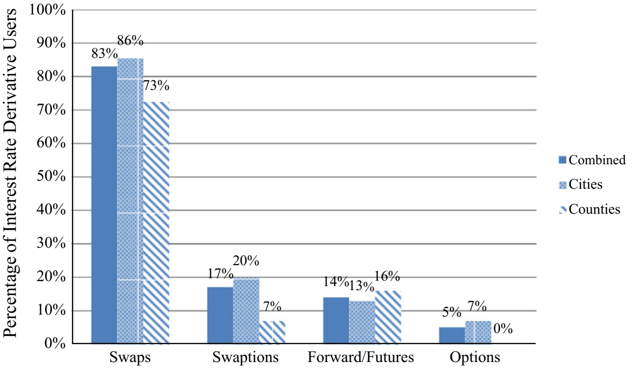

Fig. 4. Types of interest rate derivatives. The figure indicates the composition of interest rate derivative instruments in terms of swaps, swaptions, forward/futures, and options. The three blocks of each instrument separately show the percentage of derivative instruments users for combined sample, cities, and counties.

Hypothesis H2 examines whether there is a relation between growth and municipal derivative usage. We measure growth in terms of annual population growth from year $t-1$ to t (*PopGrowth*). We use this measure because population growth potentially captures the intrinsic growth in demand for services provided by a municipality. In contrast, financial measures of growth (e.g., asset growth) are influenced not only by the demand side, but also by the municipalities' ability to fulfill the demand.[13] If faster growing municipalities are more likely to use derivatives, we would expect the coefficient on *PopGrowth* (α_3) to be positive and significant.

In hypothesis H3, we argue that economies of scale lead to a positive association between municipality size and derivative usage. We measure size in terms of the log value of total assets (*LnAsset*). Size hypothesis (H3) predicts the coefficient on *LnAsset* (α_4) to be positive.

[13] However, in robustness tests we investigate the sensitivity of our inferences to alternative measures of growth. We discuss these in Section 6.3.1.

Hypothesis H4 investigates the relation between managerial opportunism and derivative usage. Opportunistic behavior by managers is likely more rampant when there are more severe agency problems and the governance mechanisms are ineffective. Zimmerman (1977) argues that agency problems in appointed manager-run municipalities are likely less severe vis-à-vis elected mayor-run cities because the city council has stronger incentives to monitor the manager. Consistent with this notion, Giroux and McLelland (2003) find manager-run cities to outperform their mayor-run counterparts along several dimensions. Hence, we measure managerial opportunism based on whether the entity is manager-run or mayor-run. The dummy variable *ManagerRun* takes the value of one if the city/county has an appointed manager and zero otherwise. Managerial opportunism hypothesis (H4) predicts a negative coefficient on the variable *ManagerRun* (α_5). However, if incentives of municipal officials and residents are aligned with respect to derivative usage, we are unlikely to find a significant coefficient on *ManagerRun* (α_5).

If less sophisticated managers are lured into derivative agreements by opportunistic investment bankers as predicted in hypothesis H5, we would expect a negative relation between managerial sophistication and derivative usage. We capture managerial sophistication based on whether the municipality is a recipient of the GFOA's Certificate of Achievement for Excellence in Financial Reporting. This certification program was established in 1945 to promote transparent financial reporting in state and local governments.[14] Municipalities appear to highly value the GFOA certification and prominently highlight it in their annual financial reports. Evans and Patton (1983) find that municipalities with professionally active officials are more likely to participate in the GFOA certification program, suggesting that municipalities with higher managerial sophistication are more likely to obtain this certification. The binary variable *GFOA* takes the value of one if the entity has been awarded the GFOA certification and zero otherwise.

Hypothesis H5 predicts a negative coefficient on *GFOA* (α_6). However, if the counterargument that sophisticated managers engage in derivative transactions while those who are less sophisticated stay away due to fear of the unknown is true, then the coefficient on *GFOA* (α_6) would be positive.

To identify any potential differences between cities and counties, we incorporate the dummy variable *County*. *County* is set to one for counties and zero for cities. We do not make any predictions with respect to the sign of the coefficient on *County* (α_7). To mitigate any regional trends, we incorporate region fixed effects based on the U.S. Census Bureau classification of regions and divisions. In order to remove broader time trends, both Models (1) and (2) also include year fixed effects.

6. Empirical findings

6.1. Descriptive statistics and univariate analyses

Table 2 presents the descriptive statistics for our sample. In Panel A of Table 2 we report descriptive statistics for the combined sample of cities and counties. Separate information for cities and counties are reported in Panels B and C of Table 2 respectively. In each panel, descriptive statistics for the full sample as well as sub-samples of derivative users and non-users are reported separately. We also indicate whether the variable means are statistically different between derivative users and non-users. For the sake of brevity we only discuss Panel A of Table 2 (combined sample of cities and counties).

As seen in Panel A of Table 2, 55% of municipalities in the sample use derivative contracts (*Derivative User*) and the average notional value of derivative positions (*Derivative NV*) among the users is \$574.33 million. Lending support to the size hypothesis, the derivative users are larger in terms of total assets (*Total Assets*), general revenues (*General Revenues*), and total population (*Population*). The average leverage (*Leverage*) is 55% and the mean credit rating (*Credit Rating*) value of 8.12 suggests an AA rating for the average municipality. Consistent with the financial constraints hypothesis, *Leverage* is higher and *Credit Rating* is lower for derivative users when compared with non-users. The mean population growth rate (*Population Growth*) is 1.22%. Contrary to predictions of the growth hypothesis, *Population Growth* is lower for derivative users in comparison to non-users (1.1% versus 1.4%). 56% of the sample

[14] See, http://www.gfoa.org/index.php?Itemid=58&id=35&option=com_content&task=view for details.

Table 2
Descriptive statistics.

	Combined sample			Derivative users			Non-users			
	(1) Mean	(2) Median	(3) S.D.	(4) Mean	(5) Median	(6) S.D.	(7) Mean	(8) Median	(9) S.D.	(10)) t-stat for (4) > (7)
Panel A: Descriptive statistics – cities and counties combined										
Derivative User	0.546	1.000	0.499	1.000	1.000	0.000	0.000	0.000	0.000	
Derivative NV	313,581	0	745,303	574,330	200,188	932,371	0	0	0	7.62***
Derivative FV	−8488.80	0	72984.31	−15547.41	−3080.85	98335.38	0	0	0	2.14**
Total Assets	6,561,074	3,552,100	8,773,046	9,182,503	5,430,511	10,881,392	3,408,507	2,606,740	3,043,093	6.36***
General Revenues	1,231,670	543,012	2,436,101	1,750,045	997,605	3,181,087	618,429	425,668	565,254	4.34***
Population	1,231,632	686,850	1,593,294	1,527,203	774,946	1,981,391	876,174	568,380	807,516	3.81***
Leverage	0.549	0.473	0.357	0.643	0.564	0.439	0.437	0.431	0.164	5.48***
Credit Rating	8.116	8.000	0.745	7.903	8.000	0.801	8.372	8.000	0.578	−6.04***
Population Growth	0.012	0.010	0.015	0.011	0.008	0.017	0.014	0.011	0.013	−2.06**
Manager Run	0.558	1.000	0.497	0.473	0.000	0.501	0.660	1.000	0.475	−3.52***
GFOA	0.902	1.000	0.298	0.940	1.000	0.238	0.855	1.000	0.353	2.62***
County	0.291	0.000	0.455	0.245	0.000	0.431	0.346	0.000	0.477	−2.06**
Panel B: Descriptive statistics – cities										
Derivative User	0.582	1.000	0.494	1.000	1.000	0.000	0.000	0.000	0.000	
Derivative NV	388,385	0	853,606	667,800	316,085	1,033,780	0	0	0	7.62***
Derivative FV	−11948.85	0	66359.35	−20545.15	−3900.00	86120.03	0	0	0	2.81***
Total Assets	6,795,294	3,494,088	9,585,168	9,478,658	5,618,064	11,787,871	3,065,418	2,612,254	1,736,877	6.32***
General Revenues	1,202,898	456,375	2,798,324	1,747,798	727,631	3,577,552	461,834	334,513	414,980	4.15***
Population	814,267	484,730	1,166,117	1,068,884	618,435	1,467,087	460,350	387,841	226,497	4.81***
Leverage	0.559	0.469	0.396	0.661	0.572	0.480	0.417	0.415	0.143	5.66***
Credit Rating	8.050	8.000	0.760	7.923	8.000	0.869	8.225	8.000	0.533	−3.32***
Population Growth	0.012	0.010	0.016	0.011	0.008	0.017	0.014	0.011	0.013	−1.27
Manager Run	0.477	0.000	0.501	0.360	0.000	0.482	0.640	1.000	0.482	−4.43***
GFOA	0.916	1.000	0.278	0.942	1.000	0.234	0.879	1.000	0.328	1.65
Panel C: Descriptive statistics – counties										
Derivative User	0.459	0.000	0.501	1.000	1.000	0.000	0.000	0.000	0.000	
Derivative NV	131,148	0	298,171	285,612	134,555	388,430	0	0	0	4.93***
Derivative FV	−50.493	0	86863.27	−109.962	−75.273	128972.05	0	0	0	0.01
Total Assets	5,989,866	3,636,902	6,380,744	8,267,715	5,131,983	7,450,705	4,055,843	2,374,797	4,546,649	3.31***
General Revenues	1,300,959	1,035,428	1,181,282	1,756,836	1,336,705	1,458,718	913,894	560,668	685,538	3.56***
Population	2,249,490	1,563,500	1,995,256	2,942,897	1,939,814	2,619,994	1,660,749	1,294,654	921,142	3.12***

(*continued on next page*)

Table 2 (*continued*)

	Combined sample			Derivative users			Non-users			
	(1) Mean	(2) Median	(3) S.D.	(4) Mean	(5) Median	(6) S.D.	(7) Mean	(8) Median	(9) S.D.	(10)) t-stat for (4) > (7)
Leverage	0.525	0.481	0.239	0.585	0.547	0.274	0.475	0.449	0.194	2.26**
Credit Rating	8.277	8.000	0.685	7.841	8.000	0.546	8.648	9.000	0.564	−7.18***
Population Growth	0.012	0.011	0.015	0.009	0.008	0.016	0.015	0.013	0.014	−1.96*
Manager Run	0.755	1.000	0.432	0.822	1.000	0.387	0.698	1.000	0.463	1.45
GFOA	0.867	1.000	0.341	0.933	1.000	0.252	0.811	1.000	0.395	1.85*

This table presents the descriptive statistics. In Panel A of this table, we report the descriptive statistics for the combined sample of cities and counties. Separate information for each group is reported in Panels B and C of this table. Columns 1, 2, and 3 of each Panel present the descriptive statistics for the combined group of derivative users and non-users while Columns 4, 5, 6 (7, 8, 9) present these separately for derivative users (non-users). Column 10 indicates whether the variable means are statistically different between derivative users and non-users. **Variable definitions:** *Derivative User* is a binary variable taking the value of one if the municipality uses at least one of the three types of derivative instruments (interest rate, foreign exchange rate, and commodity derivative) in a certain year and zero otherwise. *Derivative NV* is the notional value of interest rate, foreign exchange rate, and commodity derivative instruments. *Derivative FV* is the fair value of interest rate, foreign exchange rate, and commodity derivative instruments. *Total Assets* is the total assets of a municipality at the current year. *General Revenues* is the general revenue of a municipality at the current year. *Population* is the population size of a municipality at the current year. *Leverage* is the ratio of total liability to total assets. *Credit Rating* is sum of a municipality's General Obligation Bond Ratings from S&P, Moody's, and Fitch. Each rating is assigned a maximum value of 3, so credit rating has a maximum value of 9, with higher values representing better credit quality. *Population Growth* is the ratio of population growth from last year to the current year to last year's population. *Manager Run* is a dummy variable which equals 1 if the form of government in a municipality is Council-manager or Council-elected executive, and zero otherwise. *GFOA* is a dummy variable which equals 1 if a municipality receives the GFOA Certificate for Excellence in Financial Reporting at the current year and zero otherwise. *County* is a dummy variable taking the value of one if the municipality is a county and zero if it is a city. All financial variables are in thousands of dollars. All numbers are scaled to nearest full number and all the ratios are rounded to three decimal places.

* Significance at the 10% level (two-tailed).

** Significance at the 5% level (two-tailed).

*** Significance at the 1% level (two-tailed).

consists of manager-run municipalities (*Manager-Run*). In line with the managerial opportunism hypothesis, derivative user municipalities are relatively less likely to be run by appointed managers. More than 90% of the observations have been awarded GFOA certification (*GFOA*), but the proportion is higher for derivative users. In contrast with managerial sophistication hypothesis, this indicates that municipalities with sophisticated managers are more likely to engage in derivative transactions. Univariate tests of differences also indicate that counties are less likely to employ derivative contracts.

We report the correlation matrix of our variables in Table 3. Bold-faced numbers in Table 3 indicate correlation coefficients that are statistically significant at 10% level or better. Inferences from Table 3 are quite similar to those from the tests of mean differences reported in Table 2. Providing preliminary evidence consistent with the financial constraints hypothesis, we observe that propensity to use derivatives (*Derivative User*) is positively associated with *Leverage* and negatively associated with *Credit Rating. Derivative User* is negatively associated with population growth (*PopGrowth*), a result inconsistent with the growth hypothesis. In line with the size hypothesis, we observe a significant positive relation between *Derivative User* and *LnAsset*. The negative relation between *Derivative User* and *ManagerRun* is consistent with the managerial opportunism hypothesis. The positive correlation of *Derivative User* with *GFOA* suggests that sophisticated entities are more likely to use derivatives. We also observe a negative correlation between *Derivative User* and *County*, indicating that cities are more likely to use derivatives when compared with counties. All the aforementioned relations hold when we replaced *Derivative User* with the notional value of derivative holdings (*Derivative NV*).

While tests of mean differences and univariate correlations provide some insights on the derivative usage of municipalities, we cannot make strong inferences due to cross-correlations among variables. Therefore, we turn to multivariate analyses to more rigorously investigate our hypotheses.

6.2. Main results

6.2.1. Analyses on the propensity to use derivatives

Table 4 reports results for the probit model [Model (1)] where we investigate the factors that explain municipalities' propensity to use derivatives. Model (1) explains the propensity to use derivatives by municipalities quite well with a pseudo R-squared of over 50%.

The coefficient on *Leverage* is positive and highly significant ($\alpha_1 = 1.065$, p-value < 0.001) indicating that highly leveraged municipalities are more likely to engage in derivative transactions. Moreover, we observe a strong negative relation between credit rating and the propensity to use derivatives as evident from the negative coefficient on *CreditRating* ($\alpha_2 = -0.198$, p-value < 0.001). Together, these results strongly support hypothesis H1 that financially constrained municipalities are more likely to use derivative contracts.

The coefficient on *Popgrowth* is statistically insignificant ($\alpha_3 = -1.393$, p-value $= 0.520$). Hence, we do not find evidence supportive of hypothesis H2 that municipalities with greater growth prospects are more likely to use derivatives. Perhaps maintaining smooth cash flows to facilitate future investment needs is not a major concern for municipalities due to their ability to raise tax revenue.

Table 3
Correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) *Derivative User*		**0.80**	**−0.38**	**0.33**	**−0.29**	**−0.17**	**0.42**	**−0.19**	**0.14**	**−0.11**
(2) *Derivative NV*	**0.38**		**−0.42**	**0.32**	**−0.24**	**−0.12**	**0.52**	**−0.28**	**0.10**	**−0.14**
(3) *Derivative FV*	**−0.11**	**−0.35**		**−0.10**	**0.17**	0.08	**−0.19**	**0.16**	**−0.13**	**0.10**
(4) *Leverage*	**0.29**	**0.47**	**−0.13**		**−0.21**	**−0.28**	**0.15**	**−0.37**	**0.10**	−0.02
(5) *Credit Rating*	**−0.31**	**−0.28**	**0.11**	**−0.12**		**0.24**	**−0.25**	**0.15**	−0.05	**0.12**
(6) *PopGrowth*	**−0.11**	**−0.13**	0.07	**−0.23**	**0.24**		0.01	**0.25**	−0.03	0
(7) *LnAsset*	**0.33**	**0.70**	**−0.18**	**0.36**	**−0.14**	−0.02		**−0.15**	−0.03	−0.06
(8) *ManagerRun*	**−0.19**	**−0.33**	**0.22**	**−0.30**	**0.21**	**0.20**	**−0.24**		−0.05	**0.25**
(9) *GFOA*	**0.14**	0.09	−0.05	0.09	−0.04	−0.05	0.05	−0.05		−0.07
(10) *County*	**−0.11**	**−0.16**	0.07	−0.04	**0.14**	0	−0.05	**0.25**	−0.07	

This table presents the correlation coefficients of main variables in the test. Pearson correlation is below diagonal and Spearman correlation is above diagonal. Correlations significant at 10% level or better are bold-faced.

Table 4
Municipalities' propensity to use derivatives.

$$Prob(Deriv = 1) = a_1 Leverage + a_2 CreditRating + a_3 PopGrowth + a_4 LnAsset + a_5 ManagerRun + a_6 GFOA + a_7 County + a_j Year + a_k Region + E \quad (1)$$

		Marginal effect	P-value
LEVERAGE	α_1	1.065***	0.000
CREDITRATING	α_2	−0.198***	0.000
POPGROWTH	α_3	−1.393	0.520
LNASSET	α_4	0.271***	0.000
MANAGERRUN	α_5	0.041	0.561
GFOA	α_6	0.212**	0.048
COUNTY	α_7	−0.131*	0.076
YEAR FIXED EFFECT		Yes	
REGION FIXED EFFECT		Yes	
Observations		336	
Adjusted R-squared		0.52	

This table reports probit regression results for Model (1). The dependent variable is a dummy taking the value of one if a municipality uses at least one of three types of derivative instruments (interest rate, foreign exchange rate, and commodity) in a given year and zero otherwise. The coefficients reported are marginal effects, measuring the change in the expected value of y as one independent variable increases by unity while all other variables are kept constant. The regression controls for year and region fixed effect. P-values are reported next to coefficients. See Table 2 notes for variable definitions.

* Significance at the 10% level (two-sided).

** Significance at the 5% level (two-sided).

*** Significance at the 1% level (two-sided).

Consistent with insights from the corporate sector literature, we observe a strong positive correlation with size and the likelihood of derivative usage: The coefficient on *LnAsset* is positive and highly significant ($\alpha_4 = 0.271$, p-value < 0.001). In other words, the results reported in Table 4 strongly support our hypothesis H3.

Hypothesis H4 argues that opportunistic managers may engage in derivative transactions because of the private benefits these arrangements entail. Accordingly, this hypothesis predicts a negative coefficient on the variable *ManagerRun* as manager-run municipalities likely face lower agency problems. However, the results presented in Table 4 do not support this conjecture. The coefficient on *ManagerRun* is not statistically significant ($\alpha_5 = 0.041$, p-value = 0.561). As discussed in Section 3.4, it is possible that agency conflicts in municipal setting do not translate into significant differences in derivative usage because not only municipal officials, but residents too are likely risk averse.

Our final hypothesis (hypothesis H5) investigates whether the popular view that savvy investment bankers lure unsophisticated city officials into derivative contracts is supported by the data. If the above assertion is true, we would observe a negative relation between managerial sophistication and municipal derivative usage. On the other hand, if it is the relatively sophisticated officials who engage in derivative transactions while those who are less sophisticated stay away, then the relation between derivative usage and managerial sophistication should be positive. The results reported in Table 4 are consistent with the latter, but not the former conjecture. The coefficient on the variable *GFOA* is positive and significant ($\alpha_6 = 0.212$, p-value = 0.048), indicating that municipalities with GFOA certification are more likely to use derivatives.

We also find that when compared with cities, counties are less likely to use derivatives: The coefficient on *County* is negative and significant ($\alpha_7 = -0.131$, p-value = 0.076).

6.2.2. Analyses on the extent of derivative usage

Model (2) investigates the determinants of the extent of derivative usage in the U.S. municipalities. We restrict the Model (2) analyses for municipalities that do hold derivatives. These results are reported in Table 5. It appears that Model (2) is well specified too. Model (2) reports an adjusted R-squared of 58.5%.

Table 5
Determinants of the extent of derivative usage in the U.S. municipalities.

$$DerivNV = a_o + a_1 Leverage + a_2 CreditRating + a_3 PopGrowth + a_4 LnAsset + a_5 ManagerRun + a_6 GFOA + a_7 County + a_j Year + a_k Region + E \qquad (2)$$

		Coefficient	P-value
LEVERAGE	α_1	1002.089***	0.000
CREDITRATING	α_2	−195.291***	0.005
POPGROWTH	α_3	1134.041	0.712
LNASSET	α_4	569.868***	0.000
MANAGERRUN	α_5	164.257	0.185
GFOA	α_6	41.6754	0.831
COUNTY	α_7	−314.426***	0.008
INTERCEPT	α_0	−7068.501***	0.000
YEAR FIXED EFFECT	Yes		
REGION FIXED EFFECT	Yes		
Observations	184		
Adj. R-squared	0.585		

This table reports OLS regression for the regression on determinants of derivative usage, for the subsample of municipalities used derivatives in the sample period. The dependent variable is the notional value of total derivative instruments for a municipality in a certain year (in millions). The regression controls for year and region fixed effects. P-values are reported next to the coefficients. See Table 2 notes for variable definitions.
* Significance at the 10% level (two-sided).
** Significance at the 5% level (two-sided).
*** denote significance at the 1 percent level (two-sided).

Overall, results reported in Table 5 are quite similar to those from Table 4. In other words, it appears that factors that drive the propensity to use derivatives also influence the extent of derivative usage in municipalities. Turning to specific coefficients, we find that the coefficient on the variable *Leverage* is positive and significant ($\alpha_1 = 1002.089$, p-value < 0.001) while that on *CreditRating* is negative and significant ($\alpha_2 = -195.291$, p-value = 0.005). These findings support the hypothesis H1 and indicate that financially constrained municipalities are likely to use derivatives more extensively.

As in Table 4, the coefficient on *PopGrowth* is not statistically significant ($\alpha_3 = -1{,}134.041$, p-value = 0.712) and thus, our growth hypothesis (hypothesis H2) is not supported. Indicating a positive association between the extent of derivative usage and size, the coefficient on *LnAsset* is positive and significant ($\alpha_4 = 3569.868$, p-value < 0.001). Therefore, we find support for the size hypothesis (hypothesis H3).

As in Table 4, we do not find evidence consistent with managerial opportunism hypothesis (hypothesis H4). Coefficient on the variable of interest *ManagerRun* is not significant ($\alpha_5 = -164.257$, p-value = 0.185). While Table 4 revealed a significantly positive coefficient on *GFOA*, this coefficient is statistically insignificant in Table 5 ($\alpha_6 = 41.675$, p-value = 0.831). While managerial sophistication, measured in terms of GFOA certification, seems to be positively associated with the use of derivatives, it does not appear to influence the extent of derivative usage.

We also find that, when compared with cities, the extent of derivative usage in counties is lower. The coefficient on *County* is negative and significant ($\alpha_6 = -314.426$, p-value = 0.008).

In sum, the results reported in Tables 4 and 5 provide strong support for financial constraints hypothesis (hypothesis H1) and size hypothesis (hypothesis H3) in terms of both the propensity to use derivatives and the extent of derivative usage. But we fail to find evidence consistent with growth hypothesis (hypothesis H2) and managerial opportunism hypothesis (hypothesis H4) in either dimension. Contrary to our predictions of managerial sophistication hypothesis (hypothesis H5), we find limited evidence to suggest that sophisticated managers are more likely to engage in derivative transactions. However, this does not appear to be the case with respect to the extent of derivative usage.

6.3. Additional analyses

6.3.1. Alternative empirical measures

In our main analyses, we use population growth to proxy for growth needs of municipalities. In untabulated tests, we use alternative measures of revenue growth and asset growth to capture growth. Use of these alternative measures does not alter our inferences with respect to growth hypothesis. Our results also remain unchanged when we measure growth as a forward-looking construct (i.e. from year t to $t + 1$) as opposed to a backward looking one (year $t - 1$ to t). Additionally, our inferences on size hypothesis (H3) remain unaffected when we capture size in terms of total revenue or population.

6.3.2. Subsample analyses

6.3.2.1. Large versus small municipalities. The preceding analyses find strong support for financial constraints (H1) and size (H3) hypotheses, but not for growth (H2), managerial opportunism (H4) and managerial sophistication (H5) hypotheses. In light of these findings, we investigate whether there are incremental differences between large and small municipalities with respect to how these factors affect their derivative usage. Our investigation is motivated by suggestions made by regulators and the popular press that managerial opportunism/sophistication issues relating to derivatives could differ between small and large entities. For example, Richardson (2005), reports the following concern raised by the chief of the Securities and Exchange Commission's municipal-securities unit, Martha Haines: "The proliferation of swaps among smaller municipalities in recent years concerns me because these things are complicated... I'm concerned that little guys are getting in and don't know what they're doing."

Accordingly, we define the dummy variable *Small* to take the value of one for municipalities that are small and zero for those that are large in terms of sample median total assets and interact *Small* with the variables employed in Model (1).[15,16] These results are reported in Table 6. Our focus is on the interaction variables as they indicate the differences between small and large municipalities.

Results reported in Table 6 reveal no statistically discernible differences between small and large municipalities in terms of *Leverage*, *CreditRating*, and *PopGrowth*. We find the interaction coefficient on *ManagerRun* $*$ *Small* to be weakly positive, suggesting that managerial opportunism is less of a concern for smaller municipalities (coefficient size = 0.262, p-value = 0.061). Interestingly, we also find that the coefficient on the interaction term *GFOA* $*$ *Small* is negative and significant (coefficient size = -4.998, p-value = 0.014), while that on *GFOA* is positive and significant (coefficient size = -0.512, p-value = 0.001). In other words, these results indicate that more sophisticated officials are more likely to use derivatives in large municipalities, while less sophisticated officials are more likely to use derivatives in smaller municipalities. This finding adds some credence to the concern that smaller entities might engage in derivative transactions that they do not fully understand.

6.3.2.2. Derivative types. As previously mentioned, the vast majority of derivative users employ interest rate related derivatives. While 11% and three percent of derivative users engage in exchange rate and commodity price related derivative transactions respectively, the number of municipality-years that employ these instruments, but not interest rate derivatives, is only 10. While our inferences are not sensitive to whether we define usage in terms of total derivatives or interest rate derivative only, we do not have a sufficient sample size to conduct separate tests on entities that only employ exchange rate and commodity price derivatives.

Similarly, the most commonly used instrument type is swaps. We have only 21 observations where derivative users do not employ swaps but employ other instruments such as options, swaptions, and forward/futures contracts. All our results remain unchanged regardless of whether we pool all derivative types together or separately analyze swap users. Small sample size prevents us from conducting separate tests on entities that exclusively use options, swaptions, and forward/futures contracts.

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[15] We do not include *LnAssets* in the regression since partitioning is based on size.

[16] In untabulated tests we carry out similar analyses with Model (2) as well and find similar results.

Table 6
Propensity to use derivatives: large versus small municipalities.

$$Prob(Deriv = 1) = a_1 Small + a_2 Leverage + a_3 Leverage * Small + a_4 CreditRating + a_5 CreditRating * Small + a_6 Popgrowth + a_7 Popgrowth * Small + a_8 ManagerRun + a_9 ManagerRun * Small + a_{10} GFOA + a_{11} GFOA * Small + a_{12} County + a_{13} County * Small + a_j Year + a_k Region + E \qquad (3)$$

		Marginal effect	*P*-value
SMALL	α_1	−0.861	0.107
LEVERAGE	α_2	0.688**	0.015
LEVERAGE * SMALL	α_3	0.626	0.183
CREDITRATING	α_4	−0.307***	0.000
CREDITRATING * SMALL	α_5	0.088	0.409
POPGROWTH	α_6	−1.971	0.496
POPGROWTH * SMALL	α_7	3.315	0.436
MANAGERRUN	α_8	−0.141	0.192
MANAGERRUN * SMALL	α_9	0.262*	0.061
GFOA	α_{10}	0.512***	0.001
GFOA * SMALL	α_{11}	−4.998**	0.014
COUNTY	α_{12}	−0.196*	0.066
COUNTY * SMALL	α_{13}	0.131	0.333
YEAR FIXED EFFECT	Yes		
REGION FIXED EFFECT	Yes		
Observations	336		
Adjusted *R*-squared	0.32		

This table reports probit regression results for Model (3). Small = 1 if a municipality's total assets is below the median of total assets in the sample, and zero otherwise. The dependent variable is a dummy taking the value of one if a municipality uses at least one of three types of derivative instruments (interest rate, foreign exchange rate, and commodity) in a given year and zero otherwise. The coefficients reported are marginal effects, measuring the change in the expected value of *y* as one independent variable increases by unity while all other variables are kept constant. The regression controls for year and region fixed effect. *P*-values are reported next to coefficients. See Table 2 notes for variable definitions.

* Significance at the 10% level (two-sided).

** Significance at the 5% level (two-sided).

*** Significance at the 1% level (two-sided).

6.3.2.3. Counties versus cities. About 70% of our sample consists of cities (239 observations) while the remaining 30% account for counties (98 observations). In our main analyses, we pool these observations together and employ the dummy variable *County* to account for systematic differences between the two types of entities, if any. Our results are similar when we run separate regressions for city and county subsamples, but statistical significance becomes weaker, especially for counties. We attribute this to lack of power due to much smaller sample size.

7. Conclusions

Despite widespread usage of derivatives in the municipality sector and numerous cases of ill-designed derivative agreements causing severe financial problems for cities and counties, the academic literature on this area is still at a nascent stage. Our study is an attempt to fill this void by understanding the nature and the determinants of derivative usage among U.S. cities and counties. We do so by examining the derivative usage in a hand-collected sample of over 300 observations from large U.S. cities and counties over the period of 2005–2008.

Our descriptive analyses indicate that derivative usage among municipal governments has grown rapidly over recent years and is dominated by instruments (primarily swaps) designed to hedge interest rate exposure. With respect to the determinants of derivative usage, we find that financial constraints and size positively impact not only the propensity to use derivatives, but also the extent of derivative usage. On the other hand, we find no reliable association between growth and derivative usage. Moreover, despite concerns raised in the popular press that opportunistic behavior and/or lack of financial sophistication of city officials may drive municipal derivative usage, we find no broad evidence to indicate that municipals are more likely to use derivatives and/or are likely to use more derivatives when agency conflicts are higher or when city officials are likely less sophisticated. However, we find some evidence suggesting that managerial sophistication and the propensity to use derivatives is positively associated with larger municipalities, while this association is negative for smaller municipalities. This finding provides some validity for the concerns raised by regulators and popular press that smaller municipalities are susceptible to entering into derivative transactions that they do not fully understand.

To the best of our knowledge, ours is the first study to systematically investigate the determinants of derivative usage in the U.S. municipality sector. Our hand-collected sample is quite large in comparison to prior empirical work on government sector derivative usage. Nonetheless, we cannot completely rule out the possibility that failure to find statistically significant results for some of our hypotheses is due to low statistical power. A related concern is that some of our empirical proxies may not be powerful enough to fully capture the underlying conceptual construct.

Considering the magnitude of the municipal derivative market and the importance of the municipal sector for social welfare of citizens, our understanding of the derivative usage among U.S. municipalities is clearly lacking. Our paper is an initial attempt to shed some light on this issue. Future researchers may use our findings as a steppingstone to gain a more comprehensive understanding of municipal derivative usage. In this context, developing theories on derivative usage as they apply to municipal sector, gathering larger samples, and developing more precise empirical measures to capture underlying constructs would prove useful. Recognizing the need to understand more fully the use of derivatives in the governmental sector, in 2008 the Governmental Accounting Standard Board (GASB) issued Statement No. 53 on Accounting and Financial Reporting for Derivative Instruments (GASB 53), which mandates derivatives to be recorded at fair value in the statement of net assets. An investigation of the impact of GASB 53 on derivative usage of municipalities would add to the extant body of literature on disclosure issues in the municipality sector (e.g., Cheng, 1992; Soybel, 1992; Gore, 2004; Baber and Gore, 2008). We leave these issues for future researchers.

References

Abdel-khalik, A.R., Chen, P., 2015. Growth in financial derivatives: the public policy and accounting incentives. J. Account. Public Policy 34 (3), 291–318 (Special Issue on Accounting and Risk Management).

Baber, W.R., Gore, A.K., 2008. Consequences of GAAP disclosure regulation: evidence from municipal debt issues. Account. Rev. 83 (3), 565–592.

Braun, M.Z., 2009. JPMorgan sued for sewer bond fraud by Alabama County (Update 1). Bloomberg. <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aeEzcwih.vEI> (November 13, 2009).

Brown, G., 2001. Managing foreign exchange risk with derivatives. J. Financ. Econ. 60 (2–3), 401–448.

Cheng, R.H., 1992. An empirical analysis of theories on factors influencing state government accounting disclosure. J. Account. Public Policy 11 (1), 1–42.

Christoff, C., Preston, D., 2013. Only Wall Street wins in Detroit crisis reaping $474 million fee. Bloomberg. <http://www.bloomberg.com/news/2013-03-14/only-wall- street-wins-in-detroit-crisis-reaping-474-million-fee.html> (March 14, 2013).

Chu, E.H., Underwood, C., Fox, T.B., McMahon, J.A., Davis, R.L., Spitz, S.A., Simons III, A., Wolf, G.G., 2008. Interest rate swaps and their application to tax-exempt financing. In: Feldstein, S.G., Fabozzi, F.J. (Eds.), The Handbook of Municipal Bonds. John Wiley & Sons Inc., Hoboken, NJ, pp. 299–344.

Dodd, R., 2010. Municipal bombs. Finance Dev. 47 (2), 33–35.

Dotson, B., Spain, C., Weiss, B., 1994. Financial derivatives: governments as end users. Govern. Finance Rev. 10 (4), 13–17.

Evans, J.H., Patton, J.M., 1983. An economic analysis of participation in the municipal finance officers association certificate of conformance program. J. Account. Econ. 5, 151–175.

Francis, T., Levisohn, B., Palmeri, C., Silver-Greenberg, J., 2009. Wall Street plays hardball. BloombergBusinessweek. <http://www.businessweek.com/stories/2009-11-17/wall-street-plays-hardball> (November 17, 2009).

Froot, K., Scharfstein, D., Stein, J., 1993. Risk management: coordinating corporate investment and financing policies. J. Finance 48 (5), 1629–1658.

Geczy, C., Minton, B., Schrand, C., 1997. Why firms use currency derivatives?. J. Finance 52 (4), 1323–1354.

Giroux, G., McLelland, A.J., 2003. Governance structures and accounting at large municipalities. J. Account. Public Policy 22 (3), 203–230.

Gore, A.K., 2004. The effects of GAAP regulation and bond market interaction on local government disclosure. J. Account. Public Policy 23 (1), 23–52.

Governmental Accounting Standards Board (GASB), 2008. Derivative Instruments: A Plain-Language Summary of GASB Statement No. 53. GASB, Norwalk, CT.

Graham, J.R., Smith, C.W., 1999. Tax incentives to hedge. J. Finance 54 (6), 2241–2262.

Graham, J.R., Rogers, D., 2002. Do firms hedge in response to tax incentives? J. Finance 57 (2), 815–839.
Haushalter, D., 2000. Financing policy, basis risk, and corporate hedging: evidence from oil and gas producers. J. Finance 55 (1), 107–152.
Knopf, J.D., Nam, J., Thornton Jr., J.H., 2002. The volatility and price sensitivities of managerial stock option portfolios and corporate hedging. J. Finance 57 (2), 801–813.
Kumar, P., Rabinovitch, R., 2013. CEO entrenchment and corporate hedging: evidence from the oil and gas industry. J. Financ. Quant. Anal. 48 (3), 887–917.
Lobo, G.J., Ranasinghe, T., Yi, L., 2015. Hedging, Investment Efficiency, and the Role of Information Environment. University of Houston, Singapore Management University, University of Houston – Clear Lake. Working Paper.
McDonald, M., 2010. Wall Street collects $4 billion from taxpayers as swaps backfire. Bloomberg. <http://www.bloomberg.com/news/2010-11-10/wall-street- collects-4-billion-from-taxpayers-as-swaps-backfire.html> (November 10, 2010).
Mian, S., 1996. Evidence on corporate hedging policy. J. Financ. Quant. Anal. 31 (3), 419–439.
Minton, B., Schrand, C., 1999. The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing. J. Financ. Econ. 54 (3), 423–460.
Nance, D., Smith, C., Smithson, C., 1993. On the determinants of corporate hedging. J. Finance 48 (1), 267–284.
Nolan, K., 2010. Alabama to rein in county wracked by rate-swap debacle. Wall Street J. (Online edition, New York, NY, April 20, 2010)
Nolan, K., 2011. U.S. news: largest municipal bankruptcy filed. Wall Street J., A3 (Eastern edition, New York, NY, November 10, 2011)
Prada, P., Karmin, C., 2008. Mayor of Birmingham indicted over bond issues. Wall Street J., A3 (Eastern Edition, New York, NY, December 02, 2008)
Richardson, K., 2005. Sweet hedge Alabama: a county defends rate-swap strategy. Wall Street J. (New York, NY, June 08, 2005)
Robbins, W.A., 2009. GASB 53: new standards for derivative and hedging activities in the public sector. CPA J. 79 (4), 14.
Smith, C.W., Stulz, R.M., 1985. The determinants of firms' hedging policies. J. Financ. Quant. Anal. 20 (4), 391.
Soybel, V., 1992. Municipal financial reporting and the general obligation bond market: New York City, 1961–1975. J. Account. Public Policy 11 (3), 207–231.
Stewart, L.J., Cox, C.A., 2008. Debt-related derivative usage by U.S. state and municipal governments and evolving financial reporting standards. J. Public Budgeting, Account. Financ. Manage. 20 (4), 439–456.
Stulz, R.M., 1984. Optimal hedging policies. J. Financ. Quant. Anal. 19 (2), 127–140.
Tufano, P., 1996. Who manages risk? An empirical examination of risk management practices in the gold mining industry. J. Finance 51 (4), 1097–1137.
Tufano, P., 1998. Agency costs of corporate risk management. Financ. Manage. 27 (1), 67–77.
United States General Accounting Office (GAO), 1994. Financial Derivatives: Actions Needed to Protect the Financial System. GAO, Washington, D.C.
U.S. Securities and Exchange Commission. 2012. Report on the municipal securities market. Washington, D.C.
Zimmerman, J.L., 1977. The municipal accounting maze: an analysis of political incentives. (Studies on measurement and evaluation of the economic efficiency of public and private nonprofit institutions). J. Account. Res. 15, 107–144.